

TOPIC 2.1

How does matter affect your life?

Key Concepts

- Everything—including you—is made up of chemicals.
- Chemicals in your daily life have characteristics that make them useful, hazardous, or both.
- Handling chemicals and equipment safely is important at school and at work.

Curricular Competencies

- Ensure that safety and ethical guidelines are followed in your investigations.
- Experience and interpret the local environment.
- Consider social, ethical, and environmental implications of the findings from your own and others' investigations.
- Contribute to care for self, others, community, and world through personal or collaborative approaches.

What does the word “chemical” mean to you? Do you think of preservatives in food? Or bubbling liquids in beakers and flasks? These are chemicals, but a chemical is not necessarily dangerous or made in a laboratory—“chemical” means the same as the word “matter.”

Everything you eat, everything you wear, the air you breathe, a cell phone, a bicycle, a tree, a cat, the Sun, the planets—even you are made up of matter.

Most of the matter that you handle and come in contact with every day is safe. However, many types of matter, even things that are useful or familiar, can be hazardous. To stay safe when working with matter, it is important to know about those hazards and how to avoid them. We do this by learning how to read information labels and how to properly handle the matter we work with.



Starting Points

Choose one, some, or all of the following to start your exploration of this Topic.

- 1. Identifying Preconceptions** List five examples of matter that you relied on today. For each one, explain why you think it is matter. Based on your answers, come up with your own definition of matter.
- 2. Evaluating** Most kitchens at home today have at least some products made with plastics. Think about containers, for example. Plastic products for the home began to become widely available during the 1950s. Before then, people used materials such as glass, paper, and metal to wrap or hold food.
 - a)** What characteristics make glass, paper, and metal suitable for containers?
 - b)** What characteristics make plastic a desirable substitute for these materials?
 - c)** What are some undesirable characteristics of plastic?
- 3. Communicating** Assume you have been asked to interview a member of the health and safety committee in your school about how hazardous materials are handled in the school and what safety practices are in place. Make a list of questions you want to ask this person.



Key Terms

There is one key term that is highlighted in bold type in this Topic:

- **matter**

Flip through the pages of this Topic to find this term. Add it to your class Word Wall along with its meaning. Add other terms that you think are important and want to remember.

Everything—including you— is made up of chemicals.

Activity

Is It Really Chemical-Free?

Consider the statements below.

- A company that makes environmentally friendly products makes a cleaning cloth that kills bacteria and other germs. The cloth contains tiny bits of silver. The company says, “Silver is a metal, not a chemical.”
- Many gardeners proclaim their lawns and gardens are chemical-free. Their results depend on methods that include the use of natural fertilizers such as manure and nutrient-rich compost.

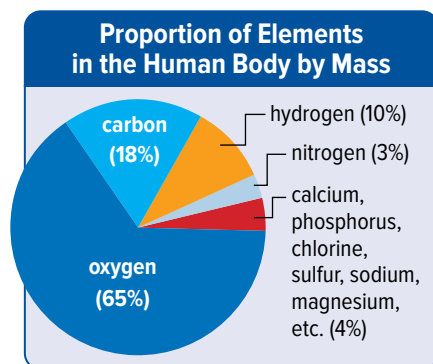
Now work together in small groups to answer the following questions.

1. What do you think “chemical-free” means, according to these statements?
2. Is it possible for any product to be chemical-free? Explain.



Do you think of yourself as being chemical-free? Think again. **Figure 2.1** shows that you are made up mostly of four types of chemicals called elements, with smaller amounts of many, many others.

Figure 2.1 All people are made up mostly of oxygen, carbon, hydrogen, and nitrogen. **Where do we get the chemicals we need for our bodies?**



Often the term “chemical” is used to refer to certain substances or mixtures of substances, such as oxygen or salt water. However, the word “chemical” does not have a specific scientific meaning. That’s because everything in the world that isn’t energy is a chemical or contains chemicals. When people

use the word “chemical,” they are really talking about matter. Anything that takes up space and has mass is called **matter**.

matter anything that has mass and takes up space



Before you leave this page . . .

1. In your own words, define the term “matter.”
2. What kinds of misunderstanding can result when people use the word “chemical” when talking about issues involving health and the environment?

CONCEPT 2

Chemicals in your daily life have characteristics that make them useful, hazardous, or both.

Activity

Common Sense Safety

Many of the products you use at home can be dangerous if not handled properly. That's why there are guidelines for using them. Copy the table and add rows for propane, soap, mouthwash, and paint. Add three more of your choice. Complete the table.

Chemicals in the Home

Matter	Useful Characteristics	Hazardous Characteristics	Rules for Handling
cleaning products	kill bacteria and other germs	can burn skin and are poisonous	use in a well-ventilated area, avoid contact with skin



Chemical Safety Around the House

Many products have symbols on them to warn of possible danger. The Hazardous Household Products Symbols (HHPS) give safety information about a product (Figure 2.2). Each symbol provides two kinds of warnings:

- whether the hazard is the container or the contents
- the type of hazard—explosive, corrosive, flammable, or poisonous

Connect to Investigation 2-A on page 107

Figure 2.2 Household hazardous product symbols are used on warning labels on many consumer products. **Name two products with HHPS on their containers.**

The Borders		The Hazards	
	Dangerous Container The border that looks like a traffic yield sign means that the container is dangerous.		Explosive This symbol means that the container can explode. If it is punctured or heated, pieces can cause serious injuries, especially to the eyes.
	Dangerous Product The border that looks like a traffic stop sign means that the contents of the container are dangerous.		Corrosive This symbol means that the product inside the container will burn the throat or stomach if swallowed and will burn skin or eyes on contact.
			Flammable This symbol means that the product will catch on fire easily if it is near sparks, flames, or even heat.
			Poisonous This symbol means that the product will cause illness or death if you eat or drink it. For some products, just smelling or licking them is enough to cause serious harm.

Before you leave this page . . .

1. What is the HHPS system? Why is it used?
2. Which HHPS would be on spray paint?

What are the hazards of pretty packaging?

What's the Issue?

Household cleaners are big business. Every year, consumers spend billions of dollars on laundry and dishwasher detergents alone. While people have been cleaning their clothes and dishes the same way for decades—using detergent and water—manufacturers are always coming up with new ways to try to make their products stand out.

Enter the detergent pod. These products were developed to make it easier for consumers to use the proper amount of detergent, as well as avoid messy bottles of liquid or boxes of powder. So what's the problem?

These detergent pods are small, bright, colourful tablets that resemble candy—especially to young children. But detergents can be poisonous. Since these pods went on the market, there has been a large increase in detergent-related poisonings in children five years old and younger. Should manufacturers be allowed to continue producing colourful detergent pods?



Dig Deeper

Collaborate with your classmates to explore one or more of these questions—or generate your own questions of interest to explore.

1. Read the label of a detergent package. Record the ingredients and research the hazards of those substances. As a result of your research, will you change the way you handle or think about using detergent? Explain why or why not.
2. Pod-related harm to children began to be reported very soon after the pods were available.
 - a) Find out about the increases in reports of detergent pod exposure to poison control centres.
 - b) What harm to children has been reported?
 - c) What have companies done to address safety concerns? Do you think the problem has been solved? Explain why or why not.
3. Some people argue that pods are helpful to consumers. Companies often rely on people using too much of a product than is actually needed, prompting them to buy more, sooner. Using a pod avoids that. However, many agencies that fight for consumer safety say detergent pods are health hazards and do not support their use. Where do you stand on this issue? Make sure to support your opinion in your answer.

Handling chemicals and equipment safely is important at school and at work.

Activity

Know Your Safety Icons

What do you think these six safety icons mean? Make a prediction for each, and then read Safety in Your Science Classroom on pages xiv–xvii to find out.












WHMIS 2015

By law, everyone in the workplace, including at school, must be informed about the chemicals they use and how to handle them safely. In Canada, this is done through the Workplace Hazardous Materials Information System, or WHMIS. WHMIS provides detailed information about how to store, handle, and dispose of chemicals. It also provides first aid information.

Figure 2.3 lists the WHMIS symbols for hazardous products. In 2015, these symbols replaced an older set of WHMIS symbols. If you look in an older science book, you may see a different set of symbols. Each chemical also has a Safety Data Sheet (SDS) associated with it. The SDS contains information about the composition and properties of a hazardous substance, as well as steps to handle and store it safely.

Figure 2.3 The WHMIS 2015 safety symbols are used throughout Canada to identify dangerous materials. **Which WHMIS symbols would you find on a container that contains a flammable gas stored under pressure?**

	Exploding bomb (for explosion or reactivity hazards)		Flame (for fire hazards)		Flame over circle (for oxidizing hazards)
	Gas cylinder (for gases under pressure)		Corrosion (for corrosive damage to metals, as well as skin, eyes)		Skull and Crossbones (can cause death or toxicity with short exposure to small amounts)
	Health hazard (may cause or is suspected of causing serious health effects)		Exclamation mark (may cause less serious health effects or damage the ozone layer)		Biohazardous infectious materials (for organisms or toxins that can cause disease in people or animals)

Staying Safe in Your School Laboratory

1. Before you begin

- Inform your teacher if you have any allergies or medical conditions, or if there are other factors that could affect your work in the chemistry lab.
- Know the location of the nearest fire alarm, fire extinguisher, fire blanket, first-aid kit, safety shower (if there is one), and eye wash station. Know how to use them.
- Study your activity, investigation, or other lab assignment carefully before you start. Ask for help if you have questions.
- Be sure you understand the safety icons.



2. Dressing the part

- Wear protective clothing as appropriate and as directed, such as a lab apron, gloves, and safety glasses.
- Tie back long hair, and secure or remove scarves, caps, ties, or long necklaces.
- Wear footwear that covers your entire foot, including toes.

3. Acting responsibly

- Never chew gum, eat, or drink in the lab.
- Work carefully with your partner or group and make sure you keep your work area clear.
- Stay focused on what you are doing. Acting irresponsibly is dangerous in the lab.



Safety in the Laboratory

Making sure that you know how to handle chemicals and equipment safely in the school laboratory is an essential part of your exploration of matter. You are responsible for the safety of everyone around you as well as your own. In addition to WHMIS, there are safety rules and icons you must know and follow. Some of these are shown in [Figure 2.4](#). Also read *Safety in Your Science Classroom* on pages xiv–xvii of this book. Your teacher may give you additional safety rules to follow.

4. Using equipment

- When carrying equipment for an activity or investigation, hold it carefully. Carry only one object at a time.
- When working with electrical equipment, make sure your hands are dry, especially when touching electrical cords, plugs, or sockets. Pull the plug, not the cord.
- Report damaged equipment to your teacher immediately.
- Place electrical cords where people will not trip over them.



5. Working with heat

- If you use a laboratory burner, be sure you understand how to light and use it safely.
- Point the open end of a container being heated away from yourself and others.
- Do not allow a container to boil dry.
- Handle hot objects carefully. Remember that glassware and equipment looks the same hot as it does cold.
- Inform your teacher if you receive a burn. Apply cold water and then ice to the burned area immediately.

6. Working with chemicals

- Read and understand all safety labels, including WHMIS symbols.
- Never taste any substances you use in the lab.
- If any part of your body contacts a substance in the lab, inform your teacher. Immediately wash the area thoroughly with cold water. If you get anything in your eyes, wash them immediately and continuously for 15 minutes.
- Handle substances carefully. If you are asked to smell a substance, never smell it directly. Hold the container slightly in front of and beneath your nose, and waft the fumes toward your nostrils.



7. Cleaning up

- Clean up any spills according to your teacher's instruction.
- Clean equipment and glassware before you put it away.
- Dispose of all materials as directed by your teacher. Never discard materials in the sink or garbage unless your teacher directs you to.
- Wash your hands thoroughly after doing an activity or investigation.

Figure 2.4 These are just some of the safety rules to follow in the school laboratory. **For each category, describe a situation in a laboratory that would apply.**

Connect to Investigation 2-B on pages 108–109

Before you leave this page . . .

1. What is WHMIS and what role does it play in laboratory safety?
2. Why is it important to have a common set of safety labels and icons for hazardous chemicals in all workplaces and schools?

Who makes sure consumer products are safe?



What's the Issue?

Many of the substances we use at home have properties that make them both beneficial and dangerous. Medications are designed to improve our health, but if taken incorrectly can cause harm. Chlorine is in household cleaners and products used to keep pools safe because it kills bacteria and other microbes. But it can also harm or even kill people. If you were working with chlorine-containing chemicals in the laboratory, you would be wearing a lab coat, safety goggles, and gloves. Who is responsible for ensuring that consumers have all the information they need to stay safe when using products?



Dig Deeper


Collaborate with your classmates to explore one or more of these questions—or generate your own questions of interest to explore.

1. The Hazardous Household Products Symbols system does not cover all consumer products. For example, medications, detergents, and many cleaning agents and personal care products are not always required to display such information.
 - a) Collect 10–12 consumer products that could cause harm if not used properly. Find as wide a variety as possible. Read the warning descriptions and instructions for what to do if an accident happens.
 - b) What could be an alternative to descriptions of hazards and the medical attention that is needed if an accident happens?
2. Many people wonder where the responsibility lies when it comes to using consumer products safely. Some argue the responsibility is in the hands of the manufacturers who make the products to provide all the information possible. Others argue that it is each individual's responsibility to use a product properly. Divide into two groups and set up a debate regarding who should be responsible for ensuring people's safety when using consumer products.
3. WHMIS 2015 incorporates the Globally Harmonized System of classification and labelling of chemicals (GHS) for Canadian workplaces. GHS is an international initiative to make all chemical hazard classifications the same throughout the world. Why is this an important step in improving WHMIS? How could this be applied to consumer products?

Check Your Understanding of Topic 2.1

QP Questioning and Predicting PC Planning and Conducting PA Processing and Analyzing E Evaluating
AI Applying and Innovating C Communicating

Understanding Key Ideas

- Steps from two different laboratory procedures are given below. Which safety icons and WHMIS symbols should be included with the procedures? More than one may apply in each case. Explain why you chose each symbol. **PA E C**
 - Pour a solution of salt water from a graduated cylinder to a beaker.
 - Light a Bunsen burner. Then gently heat the test tube containing the solution. Do not breathe in the irritating ammonia gas that forms.
- You are about to use a household product that has this symbol on its label. 
 - What does this symbol mean?
 - Describe the precautions you should take when using the product. **AI PA**
- Make a sketch of your science lab or classroom showing the location of emergency exits, eye wash stations, fire extinguishers, and any other emergency equipment. Include the name of your school's emergency first aid contact. **C**

Connecting Ideas

- Suppose you are a writer for the local community newsletter. You have been asked to interview someone at the fire department about how they deal with hazardous chemicals. Come up with a list of questions you have for the person you are interviewing. **C QP**

- Name three jobs that require a person to know about chemicals, their possible dangers, and how to work with them safely. Describe the type of chemical knowledge each job needs. **QP C PA**
- Many homes have hazardous materials. Often, people dispose of them by throwing them out in the regular garbage or flushing them down drains or toilets. **QP C AI**
 - What hazards are associated with these practices?
 - Write a public service announcement to advise people of the dangers of hazardous household products and why they should not be disposed of in this way.
 - Come up with an idea for how your local city or town council could deal with hazardous waste.

Making New Connections

- The term "green chemistry" refers to an area of chemistry that involves designing consumer products and the methods used to make them so that less hazardous material is involved. **AI C QP**
 - In what other way have you seen or heard the term "green" being used? What does the word mean when it is used that way?
 - It takes time and money for a company to change how it produces a product to make it greener. Assume you are an environmental consultant who must convince a chemical company to switch to green chemistry. Make a list of important points you will make to do this.

Make a Difference

Reducing Hazardous Waste

A product's life cycle includes all the steps in making, distributing, selling, using, and disposing of the product. Hazardous materials are used and eventually become waste at many points in the life cycle of many products.

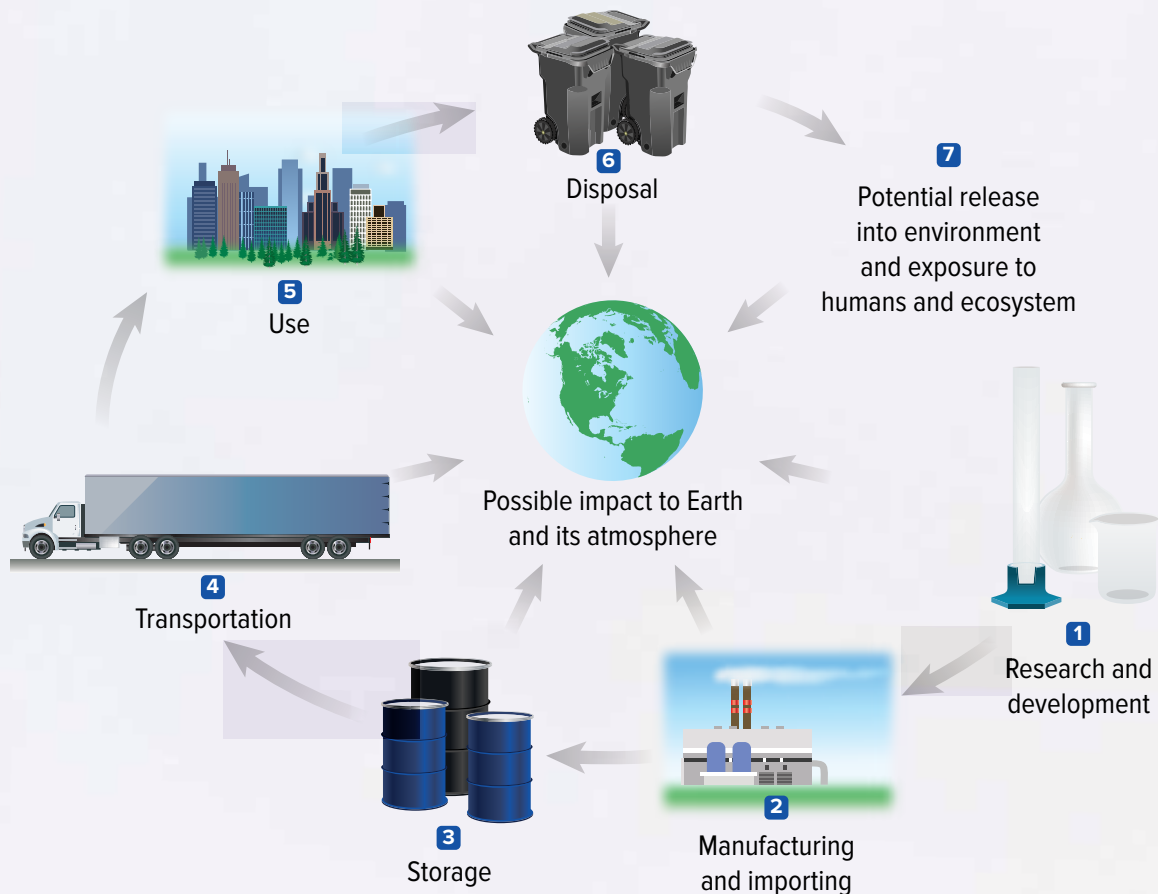
Through our own actions, including the choices we make about the products we buy, we contribute to hazardous waste in Canada. In total, Canadians

generate more than 6 000 000 t (tonnes) of hazardous waste each year.

What We Can Do

Ways to prevent hazardous waste from entering the environment include the following.

- **Reduce hazardous waste.**
People can choose to buy products made by methods that reduce



hazardous waste. Wastes can also be reduced if people buy only the amount of product they expect to use. Some hazardous substances can be replaced with less harmful substances that do the same job.

- **Recycle hazardous waste.**

E-cycling programs help keep electronic waste (e-waste) out of the environment. Through e-cycling, electronic devices may be redistributed to charities for further use. If they can't be re-used, the devices are dismantled and their parts sold for use in other applications.

- **Dispose of hazardous wastes properly.**

Home garbage ends up in landfill sites, which means any hazardous materials end up being dumped directly onto the land. Hazardous liquids poured down the drain in homes and schools end up back in the environment. Different regions have household hazardous waste drop-off sites. Schools have established procedures for disposing of liquid and solid hazardous wastes.

Planning Your Hazardous Waste Reduction

Your task is to develop a public awareness campaign about how we can prevent hazardous wastes from entering the environment. Research how your friends, your classmates, your family, and your school deal with hazardous waste. Research different ways that schools and communities in B.C. have addressed this issue.

Questions to consider when developing your campaign can include the following.

- Who will your target audience be—the whole community or students in your school?
- How will you communicate the information?
- What information do you need to research?
- How will you grab people's attention?
- How will you get people to change their habits and make extra effort to deal with their hazardous waste or change the products they buy?
- How will you assess how successful your campaign was?

Analyze and Evaluate

1. Do you consider your campaign a success? What is your evaluation based on?
2. Describe any challenges you had with developing or running the campaign. What would you do differently, if you ran such a campaign again?

Apply and Innovate

3. Suppose your local council has heard about your campaign to reduce hazardous waste and is considering expanding it. They have asked you to present the information in a meeting with council members. Develop a presentation for the council that informs them about the issue and your campaign, and includes suggestions for expanding the campaign to reach your entire town, city, or area.

Chemistry Connections

Research Scientist

Chemical Engineer

Paramedic

Environmental Chemist

Geologist

What kinds of jobs are there for people who work with matter?



Analytical Lab Technician

If you're a stickler for detail, like working with chemicals and lab equipment, and want a range of employers to choose from, check out work as an analytical lab technician.



ISO 14000 Consultant

Want a profession few people have probably heard of? ISO 14000 is a set of standards for minimizing environmental impact. ISO 14000 consultants help companies comply with the standards.



Pharmacist

Pharmacists are more than mere dispensers of medicine. They are health care collaborators, linking doctors, patients, families, and communities in the service of wellness.

Questions

1. What other jobs and careers do you know or can you think of that involve chemistry?
2. Research a job or career that interests you and involves the study of matter. What essential knowledge, skills, and aptitudes are needed? What are the working conditions like? What attracts you to this job or career?

Skills and Strategies

- Planning and Conducting
- Processing and Analyzing
- Evaluating
- Communicating

Safety

- Do not carry out your plan until your teacher approves it.
- Do not conduct your survey without an adult present.

What You Need

- paper and pencil
- rubber gloves

A Survey of Hazardous Materials in Your Home

In this investigation, you will identify and list the hazardous materials at your home.

Question

What hazardous materials are in your home, and where are they located?

Procedure

1. Make a plan for how you will conduct the survey of your home. Use the following questions to guide you.
 - How will I determine if an item is hazardous and what type of hazardous material it is?
 - What safety precautions will I take?
 - What information will I collect and how will I record my findings?
2. Have your teacher approve your plan.
3. Arrange a time when a parent or guardian can accompany you during your survey.
4. Do not handle containers that are damaged, and make sure to wash your hands when you are finished.

Analyze and Interpret

1. Did any findings from your survey surprise you? If so, explain why.
2. Did one area of the home contain more hazardous substances than others? If so, which area was it?

Conclude and Communicate

3. Compare your survey with those of your classmates.
4. Propose two ways to reduce the amount of hazardous materials in your home.
5. Do research to find less-hazardous alternatives that could replace two hazardous products in your home.

Skills and Strategies

- Processing and Analyzing
- Evaluating
- Communicating

What You Need

- Safety in Your Science Classroom on pages xiv–xvii
- Internet access
- print sources of information on WHMIS 2015
- several sample SDS
- sample chemical bottles from the lab

Practise Safety in the Laboratory

Learning how to work safely in the laboratory is an essential part of studying chemistry. Mastering these skills will allow you to enjoy investigating science for years to come. In this investigation, you will practise working with WHMIS symbols and laboratory safety procedures.

Question

What safety-related information is important when working in a laboratory?

PROCEDURE

Part A (Structured): WHMIS 2015

Answer the following questions about WHMIS 2015. Use online or print information sources as needed.

1. Describe the basic structure of the WHMIS 2015 program.
2. Why is the program now called WHMIS 2015, instead of just WHMIS?
3. What is an SDS and what information does it provide?
4. Nine WHMIS symbols are shown below.
 - a) Describe what each means.
 - b) For each symbol, give one example of a substance or material that would have it on the label.



5. Choose one chemical in the laboratory.
 - a) Describe the information on the label and what any symbols mean.
 - b) Read the SDS. Describe how you would handle the chemical if you needed to use it for an investigation.

Part B (Guided): Safe Practices

1. With a partner, develop a method that students could use to quiz each other about the safety symbols and safety procedures used in this book.
2. Exchange the method you developed in Step 1 with another set of lab partners. With your partner, use the method from your classmates to quiz each other on the safety symbols and procedures.

Process and Analyze

1. Why is it important to know the location of safety equipment in the laboratory before you start an investigation?
2. Why is tying back long hair a safety procedure in a laboratory?
3. When should a student wear safety glasses?

4. Why should a student not eat or drink in the laboratory?
5. Chemical safety in the laboratory is important. However, there are other hazards associated with laboratory work. List three hazards you might find in a chemistry lab besides chemicals. How would you avoid each hazard?

Apply and Communicate

6. Assess the method you used for quizzing your partner on safety procedures. What improvements could you make?
7. Write a brief statement to summarize why it is important to follow safety procedures in the school laboratory.
8. Design and produce a pamphlet (or other medium) to help educate a grade 6 student about how to work safely in the laboratory. Consider including some of the following features:
 - a cartoon showing what not to do
 - a list of do's and don'ts
 - a list of age-appropriate links for learning more about chemical safety